HarvestCare: Empowering Farmers with Smart Crop Disease Detection

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Abstract—Detecting disease in leaf plants is a crucial task in plant pathology and agriculture. Traditional techniques of disease identification rely on expert visual inspection, which can be subjective and time-consuming. For agriculture and plant pathology, the use of AI in leaf plant disease identification has significant potential. Early detection and prompt action are made possible, resulting in less crop loss and better disease management. An overview of a unique approach to automating the detection of leaf plant diseases using artificial intelligence (AI) techniques is given in this research paper.

Keywords: Artificial Intelligence (AI), Machine Learning, Crops, Diseases;

Introduction

A significant technical advance that has the potential to completely change the agriculture sector is the use of AI for the identification of plant diseases. The innovation involves gathering live information on plant health using sensors and cameras that have been deployed in fields. Then, AI algorithms are used to examine this data in order to find any indications of stress or disease in the plants. Manual examination, which takes time and is frequently unreliable, is a major component of traditional plant disease detection approaches. Nevertheless, thanks to the incorporation of AI technologies, farmers can now identify diseases early on, enabling fast intervention and preventing additional harm to the plants. Farmers experience a rise in agricultural output and a decline in financial losses as a result. Machine learning algorithms are used to analyse sensor and video data in AI-based plant disease monitoring systems. These algorithms can spot patterns and anomalies that can point to a plant disease or another type of stress. The technology can immediately inform farmers, enabling quick action.

Background Literature

This section discusses the research that has been done and examined to classify the leaf disease. It also provides background data and analyses of earlier research on the various technologies and approaches used in this field of study. This section, which covers pre-processing, segmentation, and feature extraction, provides an explanation of earlier studies on disease identification [1]. Agriculture is a crucial source of energy and is required for the growing population. On the other hand, plant diseases have an impact on the quantity and quality of crops grown for agricultural reasons. Therefore, early diagnosis of plant diseases is essential for preventing and controlling them.

Physical observation by experts is the traditional method devised for plant disease diagnosis, but it takes a lot of time and effort [2]. To overcome these issues, an intelligent plant disease detection model was developed. Object recognition, disease diagnosis, and pattern classification are just a few of the typical image processing tasks that deep learning (DL) has been effectively applied to. Artificial intelligence is modelled using DL as a neural network with many hidden layers and a large amount of training data. It is referred to as artificial intelligence and is based on information transfer learning [3,5].

ANNs are becoming increasingly common for assessing and forecasting water availability. The benefit of using ANNs over traditional techniques is that they can automatically produce features and disclose complex visual elements from raw data with less knowledge of the intricate structure of the underlying mechanism [6,7].

According to H. Wang et al., [8] the Plant Species Disease Detection Categorization is a computer vision task that entails deciphering the content and organisation of a digital image. Research in computer vision focuses on creating methods that give computers perception. The advantages of employing hyper-spectral photography for agricultural crops were examined by H. B. Prajapati et al. [9] The many kinds of hyper-spectral detectors and hyper-spectral metrics are covered in this review. The biggest disadvantage of adopting multi-spectral and hyper-spectral imaging technology is the high computational expense.

Sujatha, R et al., [10] examined how machine vision technology is being used in the agricultural industry for things like natural resource evaluation, precision agriculture, post-harvest food safety and quality monitoring, categorization, grouping and intelligent systems. They emphasized agricultural inspection using multi-spectral and hyper spectral images.

Proposed Methodology

Identifying the diseases of plants using artificial Intelligence involves several steps. Artificial intelligence (AI) plant disease identification requires a number of setup processes, including configuring the system to meet the required criteria and installing the necessary hardware and software components. Here are some general steps to follow for implementing the system.

Collect and label your dataset: To train your AI model, you will require a dataset of photos of diseased and healthy leaves. You can either collect your own photos or use an existing collection. Ascertain that each photograph is labelled with the appropriate disease or no-disease category.

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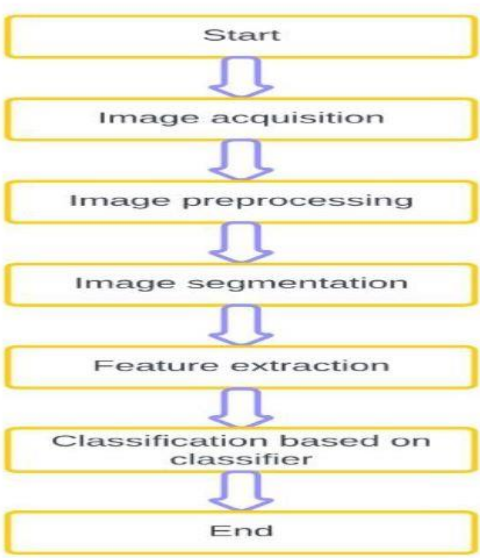
Train your AI model: You can start with a pre-trained model like Mobile Net, InceptionV3, or CNN and fine-tune it on your dataset. You may also train your model from scratch using a deep learning framework such as TensorFlow or PyTorch.

Deploy your AI model: Once your AI model has been trained, send it to a server or cloud so that it can identify photos. To host the model, you can use a cloud provider such as AWS, Google Cloud, or Microsoft Azure.

Build a user interface: Create a user interface that allows users to upload photographs and view the AI model's results. To create your UI, you can use a web framework like React or a mobile framework like React Native.

Test and refine your system. Test your system with new photographs of diseased and healthy leaves, and fine-tune your AI model and user interface as needed.

Overall, deploying an artificial intelligence-based system for identifying plant diseases necessitates careful preparation and execution, with an emphasis on data gathering, model training, deployment, user interface design, and testing.



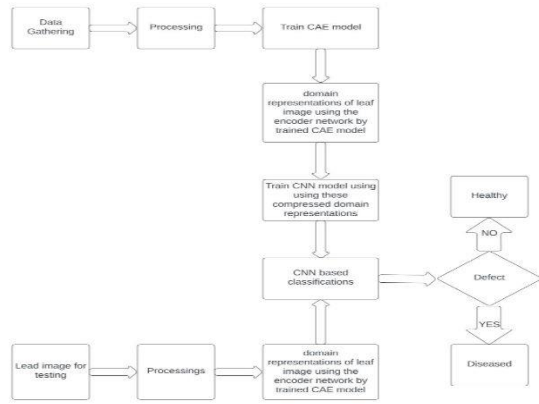


Figure: Flowchart

Results and Conclusion

The analysis findings will be presented on the website, along with a description of the plant disease discovered. Crop disease detection is an important part of agricultural management since it assists farmers in identifying and mitigating the effects of illnesses on their crops. Crop disease detection has been transformed by the combination of artificial intelligence (AI) and machine learning techniques. Artificial intelligence-based systems can analyse enormous amounts of data, such as photographs, sensor data, and historical records, to detect trends and indicators of crop disease. These systems can handle enormous amounts of data quickly, allowing for speedy and accurate diagnosis even in complex or large-scale agricultural contexts.

Early detection, targeted interventions, and less reliance on chemical treatments can all help to ensure sustainable agriculture practises, improved crop yields, economic stability for farmers, and overall food security for our rising population.

Future Scope

To further broaden the system's application, we suggest providing the system with much more training data on different other plants and diseases. By including photos of numerous additional plants, it will be possible to extract a greater variety of features from the plants, which will undoubtedly increase the system's accuracy.

By taking various plant photographs that can be included in the dataset, the system's users can also make a contribution to the system. This dataset can be utilised to create better models going forward. Additionally, the accuracy of may be increased in the future by the application of stronger algorithms. By analysing the diseases, we also suggest that the user be given access to some treatments for agricultural diseases.

This will undoubtedly assist users in avoiding similar conditions in the future. Furthermore, the medicines will assist the user in getting rid of the ailments, hence increasing their production.

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